Melvin Butte Vegetation Management Project

Hydrology Specialist Report

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Introduction

The existing condition and environmental effects for the hydrology issues in the hydrology analysis area are described in this document. Project treatments are located within the Deep Canyon watershed in portions of three subwatershed (SWS): Three Creek, Deep Canyon Dam-Deep Creek, and Snow Creek Ditch (Table 1). Two recent fires occurred in the Three Creek subwatershed, the Pole Creek Fire (2012) and the Rooster Rock Fire (2010). None of the fires occurred within the Melvin Butte Vegetation Management Project area. The Deep Canyon watershed was analyzed in the Sisters/Whychus Watershed Analysis (USDA Forest Service 1998) and the Whychus Watershed Analysis Updates (USDA Forest Service 2009, 2013b).

Table 1. Acres by subwatershed (SWS) for subwatersheds that are in the Melvin Butte analysis area. Subwatersheds in bold are within or partially within the Popper project area.

SWS Name	SWS number	SWS Acres	Acres in Project Boundary	% of SWS in Project Area
Deep Canyon Dam – Deep Creek	170703010604	31,923	267	0.8
Snow Creek Ditch	170703010602	14,636	129	0.8
Three Creek	170703010601	18,790	4060	22

Action alternatives have the potential to affect the following hydrology resources in the project area: streamflow, sedimentation, water temperature, and channel condition. Specific parameters assessed for waterbody condition will be streamflow, sedimentation, riparian vegetation and large wood.

Regulatory Framework / Management Direction

All federal land management activities must follow standards and guidelines (S&Gs) listed in the Deschutes National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 1990), as amended by the Northwest Forest Plan (NWFP) (USDA Forest Service and USDI Bureau of Land Management 1994), and any applicable Wild and Scenic River Plans. Project treatments must comply with all applicable best management practices (BMPs) (USDA Forest Service 2012b) and the Clean Water Act. All National Forest System lands in the Melvin Butte Project are under NWFP direction and are located within the matrix land allocation.

Deschutes National Forest Land and Resource Management Plan

The following standards and guidelines from the Deschutes LRMP are applicable to this project (USDA Forest Service 1990):

RP-3: Give preference to riparian area dependent resources

RP-8: Evaluate the cumulative effects of proposed projects on water quality, runoff, stream channel conditions fish habitat and adopt measures to avoid adverse effects to these resources.

RP-10: Manage woody debris and vegetation to: 1) maintain or enhance stream channel and bank structure.

RP-39: Large organic material which is beneficial to fish, wildlife or water quality will be preserved in riparian areas, stream or river channels and lakes adjacent to summer homes. Streambank erosion or esthetic enhancements are not adequate reasons for its removal. The material may be altered if it creates a safety hazard, however its contribution to riparian resources will be preserved.

Northwest Forest Plan

The Deschutes National Forest LRMP was amended in 1994 by the Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan (NWFP)) (USDA Forest Service and USDI Bureau of Land Management 1994). The Aquatic Conservation Strategy (ACS) is an essential part of the NWFP that "was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands" (USDA Forest Service and USDI Bureau of Land Management 1994). The Melvin Butte Vegetation Management Project is compliant with the ACS because only minimal activity would occur within Riparian Reserves and it would maintain or restore the ACS objectives. Compliance with the ACS is discussed in the Management Direction section of the Fisheries Report.

The NWFP provides standards and guidelines for Key Watersheds, Riparian Reserves and various management activities that prohibit or regulate activities that "Prevent further degradation of aquatic ecosystems and to restore and maintain habitat and ecological processes responsible for creating habitat over broad landscapes of public lands" (Reeves et al. 2006). Standards and guidelines for Key Watersheds, Riparian Reserves, and management activities associated with the Melvin Butte Vegetation Management Project are listed in the Management Direction section of the Fisheries Report. All proposed actions in the Melvin Butte Vegetation Management Project comply with standards and guidelines in the NWFP.

Within the project area, a portion of the Three Creek SWS is Tier 2 Key watershed under the NWFP. Tier 2 Key watersheds may not contain at risk fish stocks, but provide sources of high quality water. Three Creek subwatershed was designated a Tier 2 Key Watershed with long-toed salamander, cascade frog, and western toad as aquatic focal species in the Three Creek drainage (USDA Forest Service 2013; USDA Forest Service 1995; USDA Forest Service 2001). There are no Tier 1 Key watersheds in the project area.

Aquatic Conservation Strategy Compliance

The Melvin Butte Vegetation Management Project is compliant with the ACS because very little activity would occur within Riparian Reserves. No vegetation treatments would occur in the Riparian Reserve and only haul of harvest trees would occur on existing roads. In addition, 0.14 miles of road would be decommissioned or closed in the outer edge of the Three Creek Riparian Reserves.

Restricting haul to existing roads and implementing Project Design Criteria (see Project Design Criteria section of this report) such as regular preventative road maintenance and restricting haul on hydrologically connected segments of road to drier periods would maintain ACS objectives. Decommissioning and closing 0.14 miles of road in the outer edge of the Riparian Reserve would allow the road surface to revegetate and downwood to accumulate. The revegetation of the road surface would help dissipate overland flow energy and reduce the risk of increasing peak flows and sedimentation; therefore, restoring the ACS objectives. Based on the evaluation of the short-term, long-term, and cumulative impacts, the Melvin Butte Vegetation Management Project is designed to "contribute to maintaining or restoring the fifth-field watershed over the long-term."

Riparian Reserve and Ephemeral Draw Buffer Widths

The Whychus Watershed Analysis refined Riparian Reserves as defined by the NWFP based on average maximum tree height, the 100-year floodplain, extent of riparian vegetation, and unstable and potentially unstable lands (USDA Forest Service 1998). Site specific assessment of ephemeral draws was used to prescribe additional buffers (which are not considered Riparian Reserves) where needed to reduce potential erosion and ground disturbance in the Melvin Butte Vegetation Management area. Riparian Reserve and ephemeral draw buffer widths for the project are shown in Table 2. Ephemeral channel buffer widths were prescribed primarily as a means to preserve draw stability and keep potentially soil disturbing activities away from the channel. Forested ephemeral channels act as sediment sinks during the dry season, and are potential sources of sediment during storm events (Daniels and Gilliam 1996). Ephemeral draw buffers are not designated as Riparian Reserves and are specific to the Melvin Butte Vegetation Management project only.

Table 2: Riparian Reserve and ephemeral draw buffer widths for the Melvin Butte Vegetation Management project.

Category	Stream Class	Description	Riparian Reserve width (slope distance (ft) from edge of channel)	Buffer Width (slope distance (ft) from edge of draw)
1; 3	1 & 2; n/a	Fish-bearing streams; natural lakes and ponds	300 ft	See Riparian Reserve width column
2	3	Permanently flowing non-fish bearing streams	150 ft	See Riparian Reserve width column
3	n/a	Constructed ponds, reservoirs, and wetlands > 1 acre	150 ft	See Riparian Reserve width column
4	4	Seasonally flowing or intermittent streams, wetlands < 1 acre, unstable or potentially unstable areas, springs	150 ft	See Riparian Reserve width column
n/a	n/a	Hydrologically connected ephemeral draw features	n/a	30 ft

Clean Water Act

The Clean Water Act (CWA) is a federal law in the United States governing point and non-point source water pollution. In Oregon, the United States Environmental Protection Agency (EPA) has designated authority for compliance with the CWA to the Oregon Department of Environmental Quality (ODEQ). The CWA requires the development of water quality standards to protect beneficial uses of waters of the United States. Beneficial uses for the Deschutes River Basin include public, private, and industrial water supply, irrigation, livestock watering, anadromous fish spawning, salmon spawning, resident fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, and aesthetic quality.

The Forest Service's responsibilities under the CWA are defined in a 2014 Memorandum of Understanding (MOU) with Oregon DEQ (ODEQ and USDA Forest Service 2014). The MOU designates the Forest Service as the responsible agency for meeting the Clean Water Act on National Forest System (NFS) lands and recognizes best management practices (BMPs) as the primary mechanism for control of non-point source pollutants on NFS lands. It recognizes that BMPs are developed by the Forest Service as part of the planning process and includes a commitment by the Forest Service to meet or exceed standards. Hydrology BMPs that apply to the Project are discussed in the Project Design Criterial and BMP section of this report. To meet Clean Water Act responsibilities, the Forest Service developed a draft Water Quality Restoration Plan (USDA Forest Service 2004). The Melvin Butte Vegetation Management EA complies with both the draft Water Quality Restoration Plan and 2014 MOU.

303(d) Listed Streams

The State of Oregon is required under Section 303(d) of the Clean Water Act to identify waters that do not meet water quality standards. None of the streams in the Melvin Butte analysis area are on the Oregon 303(d) list. States are required to develop Total Maximum Daily Load allocations, which include Water Quality Management Plans for 303(d) listed waters. The Upper Deschutes River Sub-basin Total Maximum Daily Load and Water Quality Management Plans are being planned and cover all the subwatersheds in the Melvin Butte Vegetation Management Project boundary.

Watershed Condition Framework

The Watershed Condition Framework was developed as a nationally consistent, science-based approach to classify the condition of all National Forest System (NFS) SWSs (Potyondy and Geier 2010) as a means to consistently prioritize watersheds for improvement and track condition change over time. The WCF is a 6-step process, step 1 of which includes the classification of watershed condition using 24 watershed condition "attributes" to rate 12 watershed "indicators" and produce an overall Watershed Condition Class Rating. Within this context, the three watershed condition classes are directly related to the degree or level of watershed functionality and are classified as follows: Class 1 = Functioning Properly; Class 2 = Functioning at Risk; and Class 3 = Impaired Function. Watersheds are classified using attributes that quantify aquatic physical, aquatic biological, terrestrial physical, and terrestrial biological condition. Steps 2 and 3 of the WCF process include prioritization of watersheds for restoration and the development of watershed action plans outlining essential projects to improve watershed condition. Steps 4-6 include implementation of essential projects within priority watersheds, monitoring of watershed restoration efforts, and aggregation of program performance data for national reporting.

All SWSs that intersect the Deschutes National Forest were analyzed during the National Watershed Condition Framework process and ranked in 2011. Through this process, the Upper Whychus Creek SWS was identified as a priority for restoration. The 2011 Upper Whychus Creek Action Plan outlines essential projects to improve watershed condition from functioning at risk to functioning properly within the next 5 years (USDA Forest Service 2011b).

As part of the 2013 Whychus Watershed Analysis update, subwatersheds included in the analysis area were re-evaluated using the WCF process to include changes from the Pole Creek Fire, and other watershed changes that could affect condition. Watershed condition ratings from the 2011 and 2013 analyses for the subwatersheds in the Whychus Watershed Analysis area are shown in Table 3. The Melvin Butte Vegetation Management Project would not result in a change in watershed condition for any SWS within the Hydrologic Analysis Area; as discussed in the Effects Analysis of this report there would be no significant effect to hydrologic parameters from the project.

Table 3: SWS rating using the Watershed Condition Framework. A portion of the subwatershed in bold is within the Melvin Butte Vegetation Management Project area.

Subwatershed	2011 WCF rating	2013 WCF rating	Comments
Headwaters Whychus Creek	Functioning properly	Functioning at risk	Change in rating from Pole Creek fire effects
Lower Trout Creek	Functioning at risk	Functioning at risk	
Three Creek	**Functioning at risk**	**Functioning at risk**	
Upper Trout Creek	Functioning properly	Functioning properly	
Upper Whychus Creek	Functioning at risk	Functioning at risk	National Priority Subwatershed

Analysis Methods

The hydrologic analysis area for analysis of direct, indirect, and cumulative effects of the Melvin Butte Vegetation Management Project is the Three Creek SWS. Three Creek goes subsurface before exiting the SWS; therefore, SWSs downstream of the project area were not included in project analysis. The potential effects of

the Project are no longer relevant or quantitatively or qualitatively meaningful at a scale larger than the SWSs where treatments are located because there are no treatments proposed near streams or within Riparian Reserves, and additional BMPs and project design criteria would avoid treatments in other hydrologically connected and sensitive areas. Although two intermittent streams (equaling 0.2 miles) within the Snow Creek Ditch SWS are within the Project area, only 129 acres of the SWS are within the Project area. Given that no treatment would occur in Riparian Reserves and very little of the SWS is within the Project area (less than 1%), Snow Creek Ditch SWS was not included in the hydrology analysis area; however, effects to the intermittent streams are discussed. Deep Canyon Dam SWS was not included in the hydrology analysis area because only 267 acres (less than 1% of the SWS) are in the Project area and there are no waterbodies near the Project area.

Activities in areas that contribute water, shade, or sediment to streams or wetlands can affect water quality or quantity; therefore, activities within Riparian Reserves and potentially hydrologically connected areas (roads and hydrologically connected ephemeral draws) are the focus of this analysis. Various federal plans identify riparian buffers in order to protect water quality, channel stability, and large wood debris recruitment (NWFP, DLRMP, INFISH). A compilation of studies on effectiveness of riparian buffers (Belt et al. 1992) concluded that non-channelized sediment rarely travels more than 300 feet, and that 200-300 foot riparian "filter strips" are generally effective at protecting streams from sediment from non-channelized flow (USDA Forest Service and USDI Bureau of Land Management 1995).

Treatment alternatives will be analyzed based on their potential effects to the hydrology issues of streamflow, sedimentation, water temperature, and waterbody condition. These hydrology issues will be analyzed through the measures outlined in Table 4. Past, present and reasonably foreseeable projects within the hydrology analysis area were evaluated to determine potential cumulative effects from the project. Activities in the cumulative effects analysis area for all resources are shown in Chapter 2 of the EA and individual activities in the hydrology cumulative analysis area discussed in the Cumulative Effects section of this report.

Table 4. Measures for evaluating the effects of these treatments on the Aquatics resource are:

Issue	Measures
Streamflow	• Acres of soil detrimentally impacted in Riparian Reserves. • Acres of soil detrimentally impacted in potentially hydrologically connected areas (ephemeral draws). • Miles of hydrologically connected road closed or decommissioned. • Percent of project area with a high or moderate fire hazard rating.
Sedimentation	• Acres of soil detrimentally impacted in Riparian Reserves. • Acres of soil detrimentally impacted within 30 ft of potentially hydrologically connected areas (ephemeral draws). • Miles of hydrologically connected road closed or decommissioned. • Miles of hydrologically connected temporary road constructed or used. • Percent of project area with a high or moderate fire hazard rating.
Water Temperature	• Acres harvested in Riparian Reserves. • Percent of project area with a high or moderate fire hazard rating.
Waterbody Condition	• Alteration of stream/lake bank and bed stability measured by changes in sedimentation, and water yield using measures described above. • Acres treated in floodplain. • Acres harvested in potential large wood recruitment areas in Riparian Reserves. • Percent of project area with a high or moderate fire hazard rating.

Acres of treatment for the Action Alternatives within each SWS within the hydrology analysis area are shown in Table 5. For each hydrology measure, effects for Alternatives 2 and 3 are analyzed together because effects are not expected to differ between the two Alternatives. Although in Alternative 3 there are 71less acres treated than in Alternative 2, these acres all occur outside of Riparian Reserves and in the Snow Creek Ditch SWS and would not affect hydrology parameters. The other difference between Alternative 2 and 3 is that under Alternative 3 the mistletoe treatments change to thinning prescriptions and the mixed conifer treatments would not have small group openings. The effects of changing these treatment prescriptions do not change the effects to any hydrology measure; the same areas would be treated, and the same infrastructure including haul roads, skid trails, and landings would be needed for each Action Alternative.

Table 5. Watershed hierarchy, and project and treatment acres for the Melvin Butte Vegetation Management Project.

SWS name	SWS acres	Alt. 2 Treatment acres	Alt. 2 Treatment acres	Road Decommissioning Alt. 2 & 3	Road Closures Alt. 2 & 3
Deep Canyon Dam – Deep Creek	31,923	267	267	0.3	0
Snow Creek Ditch	14,636	129	57	0	0
Three Creek	18,790	4060	4060	6.1	6.2
Total	N/A	4456	4384	6.4	6.2

No treatments would occur in Riparian Reserves. The only activities that would occur in Riparian Reserves would be the closure and decommissioning of 0.14 miles of road in the outer extent of the Riparian Reserve and hauling on existing roads. Approximately 0.8 miles of non-system roads would be used as temporary roads but no new temporary roads would be constructed nor would any temporary roads be located in Riparian Reserves. Project Design Criteria and Best Management Practices designed to protect the hydrology resource are discussed in the next section.

Within the Melvin Butte Project Area 6.4 miles of road would be decommissioned and 6.2 miles would be closed under the Action Alternatives. A 0.02 mile section of existing non-system road connecting two system road segments will be converted to a Level 2 (Open) system road. All the roads proposed for decommissioning and closure would help reduce open road densities, which was addressed as an aquatic concern in the Whychus Watershed Analysis and Update (USDA Forest Service 1998, 2009). Approximately 2.3 miles of road proposed for decommissioning (Roads 1620-377, 1624-360, 1628-113, 626, 629) and 4.1 miles that are proposed for closure (Road 1620-570, 1628-106, 107, 200, 500, 605) are within the Riparian Reserve or interact with an ephemeral channel. Decommissioned roads have no long term needs, are not planned to be used again and will be removed from the transportation system status. Treatment would involve "hydrologically closing" roads and could potentially include subsoiling/ripping or recontouring the road surface. Closed roads are inactivated or operational maintenance level 1 roads. While remaining on the transportation system they are managed in a storage or closed category, and only non-motorized vehicles or USFS vehicles receiving special permission are allowed. A closed road is "hydrologically closed," even though the landscape is not restored to its original shape. Hydrologically closing a road is intended to leave the road in a "self-maintaining" state and would include repairing any drainage problems, potentially removing culverts from stream crossings, and installing a

closure device (i.e. barricade, earth berm, logs, gates, etc.). Neither decommissioned roads nor closed roads would be on the Motorized Vehicle Use Map and motorized access would not be allowed on these roads.

Project Design Criteria and Best Management Practices - Aquatics

Best Management Practices (BMPs) and Project Design Criteria (PDC) were developed for the Melvin Butte Vegetation Management Project using the National Core BMP Technical Guide (USDA Forest Service 2012b) based on recommendations in the 2013 Whychus Watershed Analysis Update (USDA Forest Service 2013b), field verification, and the best available science. The BMP and PDC that provides the most protection for the hydrology resource in the Melvin Butte Project area is restricting ground disturbance within Riparian Reserves to road closure and decommissioning. Any springs, wetlands, or ephemeral channels found during Project implementation that were not originally mapped or identified should be protected by using the Riparian Reserve and ephemeral channel buffers identified in this EA (Table 2). BMPs and PDC were discussed with operations personnel to ensure feasibility for implementation effectiveness. BMPs and PDC are discussed throughout the effects analysis of this report and are the primary mechanism to mitigate potential hydrologic effects from the project.

BMP implementation and effectiveness has been systematically monitored across National Forest Lands in California since 1992. From 2008-2010, randomized monitoring showed 91% of BMPs were implemented, and 80% of implemented BMPs were rated effective. BMPs for timber harvests, fuels treatments, and vegetation management were consistently highly effective, while BMPs for other activities, including roads, range management, recreation, and mining, were less effective (USDA Forest Service 2013a). At sites where BMPs were not implemented or effective the monitoring program includes a strong feedback loop to take corrective action on non-compliance scenarios.

At the national scale, a consistent program to monitor BMP implementation and effectiveness has been in development for several years. Monitoring of BMP implementation and effectiveness using the national BMP protocols has taken place on the Deschutes National Forest since 2011. Monitoring results from vegetation management projects indicate that BMPs intended to minimize effects to water, aquatic and riparian resources were successfully implemented, and BMPs intended to minimize effects from landings and ground-based mechanical harvest were successfully implemented, including landing location, spacing of skid trails, and retention of cover (USDA Forest Service 2011a, 2012a). Select BMPs, PDC, and project design elements are shown in Table 6.

Table 6: Select project design considerations, BMPs, and PDC for the Melvin Butte Vegetation Management Project.

Practice	**Initial Project Design Element**	**BMP/PDC**
No harvest, mowing or prescribed fire in Riparian Reserves	X	X
Buffer ephemeral draws and limit designated crossings (see specifics below)		X
Buffer ditches according to Forest ditch guidance (see specifics below)		
No new road construction	X	X
No temporary road or landing construction or use in Riparian Reserves		X
No haul on hydrologically connected roads or roads within riparian reserves when conditions are wet and can cause sedimentation to reach Three Creek (see specifics below)		X
No haul across stream fords when streams are flowing		X
Improve drainage on unstable hydrologically connected roads before haul can occur and regular preventative maintenance (see specifics below)		X
Closure of 6.2 miles of road upon project completion	X	
Planned decommission of 6.4 miles of road	X	
Obliterate all temporary roads		X
Installation of waterbars on skid trails where needed		X

Construction of new landings and skid trails would be minimized		X
No ground-based harvest on slopes over 30%	X	

Initial project design elements were included in the development of the Proposed Action. BMPs were developed using recommendations in the National Core BMP Technical Guide (USDA Forest Service 2012b), and site-specific analysis of the project area

Project Specific Design Criteria

Ephemeral Channels -

- The intent of this design element is to protect the integrity of the channel banks, provide for wood recruitment, reduce sedimentation, and dissipate stream energy.
- Mechanical treatment, including mowing, is not allowed within 30 ft of ephemeral channels, unless approval is granted by a hydrologist or fish biologist to allow some treatment in low risk areas. Underburning is allowed.
- Hand-thinning or minimal reaching in with equipment is permitted but cutting any trees within the channel or on the banks is not allowed.
- Allow crossings of channel at designated areas during dry season or unless approval is granted by a hydrologist or fish biologist
- Do not locate slash or burn piles in swales, washes, or depressions.

Ditches

- The intent of this design element is to protect the integrity of the ditch and protect stream water quality.
- Ditches and channelized streams that are functioning as a stream should be buffered based on the class of stream for which they are functioning (i.e. Class 4 buffer if the ditch is intermittent, etc).
- Ditches that do not connect back to a stream (i.e. they feed out into a pasture or irrigation device) should be buffered 30 ft to protect the integrity of the channel. No mechanized equipment is allowed within the buffer. Hand-thinning or reaching in with equipment is permitted but do not cut any trees within the channel or on the banks. Do not fell or yard any trees across the channel in order to protect channel integrity.
- Abandoned ditches with no active water rights to use the water in the future do not need a buffer.

Haul Roads

- The intent of this design element is to reduce sedimentation to Three Creek caused from hauling.
- Consult with a hydrologist or soil scientist to determine if roads are too wet for haul.
- Roads that may need maintenance or that should be monitored for excessive wetness in hydrologically connected areas are (other roads may be identified in the field):
    - 1620-377 – adjacent to ephemeral draw, decommission after use;
    - 1620-570 – adjacent to ephemeral draw, close after use;
    - 1620-880 – adjacent to ephemeral draw;
    - 1624-360 – adjacent to ephemeral draw, decommissioning after use.

Streamflow

Existing Condition

Precipitation in the analysis area ranges from 50 inches a year near Three Creek Lake to 15 inches a year near Sisters, OR. However, the range in precipitation in the project area is only 40 in/yr to 25 in/yr, with a mix of snow and rain. Elevations in the project area range from 4200 ft to 6200 ft; therefore, approximately 50% of the project area is within the rain-on-snow zone (approx. 3500-5000 ft) which includes the lower 0.7 miles of the Three Creek Riparian Reserve. Although a portion of this subwatershed experiences a significant amount of

precipitation and some high intensity storms, there is very little surface channel flow, as is seen by the low drainage density. Surface drainage in the hydrology analysis area is low because the predominately volcanic soils are highly permeable. Overland flow rarely occurs in soils within the hydrology analysis area because infiltration rates generally exceeded typical rainstorm rates by an order of magnitude (Litton 2006). Increases in overland flow can lead to increases in high flows which are the more erosive streamflows. The mechanisms with the potential to increase overland flow include reduction in canopy cover and attendant reduction in evapotranspiration and canopy interception of rain and snowfall. These mechanisms can increase the amount of precipitation available for runoff as streamflow. Within the hydrology analysis area, overland flow does not generally occur from a reduction in evapotranspiration when trees are harvested or killed by fire or insects and disease because infiltration and permeability rates often still exceed precipitation rates (Craigg 2009). However, overland flow can occur in areas where infiltration rates are reduced, such as rain-on-snow zones and road surfaces.

Roads in the project area continue to be a source for increasing overland flow in the project area. The Whychus Watershed Analysis 2013 Update analyzed road density and riparian road miles (USDA Forest Service 2013b). Overall road density (including known non-system roads) and road-stream crossings are high in Three Creek subwatershed. According to the document, "Determining Risk of Cumulative Watershed Effects Resulting from Multiple Activities", road densities above 4.6 are considered high in relatively low relief subwatersheds (USDA Forest Service 1993). Although road density is high, mostly roads adjacent to streams, crossing streams, or hydrologically connected to streams via road ditches have an influence on streamflow or water quality.

Three Creek subwatershed was analyzed during the Forest Watershed Condition Framework (WCF) process. A component of the classification is the evaluation of the "terrestrial physical" condition and includes evaluation of open road density, road maintenance, proximity to water, mass wasting potential. Each of these are scored based on if they are functioning properly (good), functioning at risk (fair), or have impaired function (poor) and then averaged to give an overall roads indicator value. The Three Creek subwatershed was rated as fair for the roads indicator value; however, the rating may be worse because it assumed open road densities are low in these systems but many closed roads are still physically open and used by the public. The Travel Management Rule was implemented in October 2011 and it restricts motorized vehicle use to Level 2 or greater (i.e. open roads) roads, which, over time, may allow level 1 (closed roads) to actually function as closed roads.

Roads throughout the Pole Creek Fire area were damaged by increased runoff in two October storms following the Pole Creek Fire. Under the Pole Creek Burned Area Emergency Response (BAER) in 2012 and 2013 various road improvements were conducted to reduce streamflow and sedimentation effects caused by the fire (USDA Forest Service 2012c). In the Three Creek SWS a new culvert was installed under the 16 Road at an ephemeral draw that started flowing after the fire and the 1600-700 road was reconstructed after it washed out. Both of these road improvements occurred within the Melvin Butte Project area in 2013.

Three Creek is the only perennial stream in the Project area and it becomes intermittent within a half a mile of the upstream boundary near the 1628-600 road. There are two intermittent unnamed streams in the southern tip of the project area (Snow Creek Ditch SWS) and a few ephemeral channels throughout the project area (Table 7). All channels flow southwest to northeast and infiltrate before connecting with a major stream network or the Deschutes River. Melvin Spring is outside the project area but within the analysis area on the west side. It is a perennial spring that historically drained into the Three Creek drainage downstream of the private land, but now flows a half mile then is ditched to the east for irrigation on private land. In addition, an intermittent tributary to Three Creek flows into Three Creek just upstream of the Project boundary.

The Pole Creek Fire (2012) occurred upstream of the Project area and only burned 8% of the Three Creek subwatershed and no land directly adjacent to Three Creek. The Rooster Rock Fire (2010) occurred downstream of the Project area mostly on private land and also only burned 8% of the subwatershed. Approximately 6.2 miles of Three Creek ran through the Rooster Rock fire area (5.5 mi on private land and 0.7 mi on USFS land) and adjacent lands experienced a mostly moderate severity burn.

Table 7. Streams and their flow regime in the Melvin Butte Analysis Area.

Subwatersheds	Perennial stream miles in SWS	Intermittent stream miles in SWS	Primary stream	Within Project Area	Flow Regime
Deep Canyon Dam-Deep Canyon	0	25	Intermittent streams	N	Snow-melt
Three Creek	6.6	9.4	Three Creek	Y	Snow-melt/lake controlled
			Melvin Spring	N	Spring
			Intermittent tributary	N	Snow-melt
Snow Creek Ditch	0	24.4	Intermittent streams	Y	Snow-melt
Total in Analysis Area	6.6	58.8			

Three Creek has a snow-melt flow regime but it is controlled by Three Creek Lake and Little Three Creek Lake in the headwaters (outside of the project area) and is influenced by numerous springs; therefore, it has a more stable flow regime. In the headwaters, Three Creek is low gradient with many small perennial tributaries. Downstream of the 16 Road and through the Project reach, Three Creek flows through a steep, confined canyon and becomes intermittent downstream of the 1628-600 road, near the abandoned Snow Creek Irrigation District Ditch. Based on the LiDAR image, it appears that historically Three Creek flowed, most likely intermittently, past Highway 20 and into McKenzie Canyon. It's unlikely that it ever reached the Deschutes River. Due to irrigation diversions that began as early as 1886, Three Creek only flowed to approximately the 1612 road (4 miles downstream of the Project boundary); however, in 2004 irrigation rights were cancelled and now Three Creek has been flowing all the way to the Mainline Rd (USFS 4606 rd), then down the Plainview Ditch (both ditches divert water from Whychus Creek) because there is no culvert under the Harrington Loop Road or Highway 20 to allow the flow to remain in the historic channel (Griffin 2011). Based on the Burned Area Emergency Response reports for both fires and the Whychus Watershed Analysis Update, increases in peak flows in Three Creek could occur because 16% of the subwatershed was burn, 11% of which occurred in the rain-on-snow zone (USDA Forest Service 2010, 2012c, 2013b).

The intermittent stream in the Snow Creek Ditch subwatershed originates from drainage off of Tam McArthur Rim. It flows intermittently through the southeast corner of the project area and is joined by two other small tributaries before leaving the project area. These streams begin flowing subterranean before they reach Highway 20 and never reach another larger surface connection.

Fire behavior modeling within the Melvin Butte Project area shows that under the existing condition 68% of the project area has a high or moderate fire hazard rating. Moderate and high hazard areas would require heavy equipment such as dozers, and/or aerial methods to effectively suppress a wildfire (NWCG 2006). As stated in the Fuels Report for this project, "Moderate and high hazard areas also have an increased likelihood of negative resource and social effects from wildfire such as fire fighter safety, public safety concerns, resource damage, and smoke production." Acres with high or moderate fire hazard have a higher potential for stand mortality due to a wildfire and will be more difficult to suppress than low hazard areas, however this does not mean that low hazard areas are "fire-proof" or have a reduced likelihood of future fire occurrence (see Fire/Fuels report). Fires burning in the high and moderate fire hazard areas within Riparian Reserves or outside of Riparian Reserves but within stream drainages could have impacts on stream flow, sedimentation, channel condition, and stream shade.

Direct and Indirect Effects––Alternative 1

The effect to streamflow under the No Action Alternative would remain the same as described in the existing condition because no project activities would occur. Roads in poor condition would continue to intercept flow and could contribute to slight increases in peak flows. The hydrologic effects of roads and the interaction between road and fire effects would continue. Hydrologically connected roads that are not physically closed or hydrologically stable may continue to supply overland flow to streams because these road would not be decommissioned or closed under the Project. Effects of both the recent fires and tree mortality from insects and disease could increase peak flows. These effects are discussed in detail in greater detail in the Whychus Watershed Analysis Update (USDA Forest Service 2013b). Fire Hazard Modeling shows 68% of the project area and more than 80% of the area directly draining into Three Creek has a high or moderate fire hazard rating. Given that much of the drainage area of Three Creek has a high or moderate fire hazard rating, it's likely that much of the vegetation in the Three Creek drainage area could be denuded and other destructive activities associated with fire suppression such as fire line construction, staging areas and safety zones could occur if a wildfire were to ignite. Therefore, effects from a moderate to high vegetation mortality fire in this drainage could temporarily increase high flows and sedimentation. Increased high flows could exacerbate the flooding issue downstream in the Plainview area. Issues and measures to assess effects to streamflow are shown in Table 8.

Table 8: Issues and measures to analyze effects to streamflow.

Issue	Measures	Alternative 1	Alternative 2 & 3
Streamflow	Acres of soil detrimentally impacted in Riparian Reserves.	0	0
	Acres of soil detrimentally impacted in potentially hydrologically connected areas.	0	0
	Miles of hydrologically connected road closed or decommissioned	0	6.4
	Percent of project area with a high or moderate fire hazard rating.	(H) 45% (M) 23%	(H) 7% (M) 13%

Direct and Indirect Effects––Alternative 2&3

The Action Alternatives would not negatively affect streamflow because no treatments would occur in Riparian Reserves or hydrologically connected ephemeral channels. A potential beneficial effect to streamflow from the Action Alternatives includes closing or decommissioning 6.4 miles of road in hydrologically connected areas. Also, reducing the percent of the project area threatened by wildfire ultimately results in a reduction of threat to the Riparian Reserves.

As mentioned earlier, overland flow in the project area does not generally occur from a reduction in evapotranspiration when trees are harvested because infiltration and permeability rates often exceed precipitation rates. In addition, the majority of vegetation treatments are understory removal in over-stocked stands; therefore, thinning would help move the stand toward more historic conditions. Vegetation treatments outside of the Riparian Reserves that could affect overland flow due to the amount of live vegetation removed are ponderosa pine dwarf mistletoe treatments and mixed conifer with group opening treatments. These treatments, which would only occur under Alternative 2 and would total 1051 acres, could create small openings between 1 and 3 acres which would reduce the amount of vegetation interception and evapotranspiration and may trap more snow. Although small openings would be created in the lodgepole pine treatment areas, these openings would occur in dead stands that are already more open and no longer evapotranspiring. The hydrologic processes of reduced interception and evapotranspiration and increased snow retention could increase overland flow and potentially more erosive high streamflows if these areas drain to streams.

Neither of these silvicultural treatments are located within 300 ft of the perennial reach of Three Creek, 150 ft of intermittent channels, or 30 ft of ephemeral channels. In the dwarf mistletoe treatments (only Alt. 2) only infested trees would be killed and/or removed. In the mixed conifer with group openings treatments (only Alt. 2), openings would be scattered and less than 3 acres. Given that none of treatments are located within Riparian Reserves or hydrologically connected areas, overland flow effects from these treatments would not affect streamflow.

Closing and decommissioning 6.4 miles of road in hydrologically connected areas such as 0.1 miles in Riparian Reserves and 6.3 miles that parallel or cross ephemeral channels would reduce overland flow effects caused by compaction and lack of down wood or vegetation. Fracturing the road surface, installing water bars, and allowing the road to revegetate and maintain down wood would reduce overland flow contribution to stream channels during high flow periods.

Fire Hazard Modeling shows that the combined high and moderate fire hazard rating was reduced from 68% to 21% under Alternatives 2 and 3 (Table 8). The likelihood that a wildfire could cause stand replacing mortality in the Three Creek drainage area is estimated to be reduced and may not lead to significant streamflow changes if a wildfire were to occur under the Action Alternatives because fire suppression effectiveness would be increased.

Sedimentation

Existing Condition

The amount of fine sediment transported to or eroded within a stream channel can affect the beneficial uses of water and is frequently used as a measure of overall water quality. Oregon administrative rules addresses sediment through a turbidity standard that states, "No more than 10 percent cumulative increases in natural streams turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity-causing activity" (OAR 340-041-0036; ODEQ 2011). For this report, sedimentation, including turbidity and fine sediment in substrate, will be analyzed because of the effects on channel morphology and aquatic species. The Sisters Ranger District has monitored turbidity, percent fine sediment in spawning gravels, cobble embeddedness, and bank stability, all of which are parameters associated with fine sediment.

Pebble counts performed in 2007 show that fine sediment in Three Creek is generally low with the highest concentration in the reaches downstream of the 16 road. The number of stream crossings is high in the Three Creek subwatershed and the higher concentration of fines may be a result of sediment running off from the road. Fine sediment may have increased temporarily downstream of the Project area in the Rooster Rock fire area, but is likely close to pre-fire conditions since ground vegetation has been recovering for the last 4 years and down wood has been increasing. Due to generally low fine sediment concentration, substrate embeddedness is likely low. Streambank stability is high and is probably a result of a lake controlled flow regime, floodplain connection, and lack of roads in the steeper reaches of Three Creek (see Fisheries Report). Although the 16 road crosses Three Creek and parallels it in the upper reach, the stream and floodplain gradient is flat and there is a highly functioning riparian/wetland buffer. The culvert appears to the appropriately sized for the discharge and channel bankfull width. Sedimentation in Three Creek Lake and Little Three Creek Lake is likely elevated due to the intensive recreation impacts to the shore. Much of the ground has been compacted from vehicles and/or camping and riparian vegetation has been denuded in most high use areas.

Direct and Indirect Effects –Alternative 1

The effect to sedimentation under the No Action Alternative would remain the same as described in the existing condition because no project activities would occur. Measures used to analyze the potential sedimentation effects and compare alternatives of the Melvin Butte Vegetation Management Project are shown in Table 9.

Hillslope erosion may increase from a reduction in live canopy and consumption of organic material on the forest floor from the recent fires, especially in stands that burned at high intensity. This could increase sedimentation in stream reaches adjacent to high intensity burned Riparian Reserves. Down wood from falling dead trees would increase over the next 3-7 years and provide surface roughness to help trap and store sediment.

The hydrologic effects of roads and the interaction between road and fire effects would continue. Roads in unstable condition would continue to deteriorate, and sediment delivery would continue to occur, especially on hydrologically connected roads that were impacted from increased runoff following the recent fires. In addition, hydrologically connected roads that are not physically closed or hydrologically stable may continue to supply sediment to streams when overland flow occurs because these road would not be decommissioned or closed under the Project.

Over 80 % of the Three Creek drainage area has a high or moderate fire hazard rating. Given that much of the drainage area has a high or moderate fire hazard rating, it's likely that much of the vegetation in the Riparian Reserve could be denuded, even in the low hazard areas. Despite high to moderate vegetation mortality from wildfire, soil burn severities in these soil types are generally low to moderate, with approximately 2% in the high burn severity category based on data from the Black Crater, Lake George and GW Fires (see Soils Report). In addition, the soil types found in the project area tend to show an increase in infiltration after they've been burned despite burn severity and generally do not show increased signs of hydrophobicity from fire. Although infiltration generally increases in these soil types after a fire, during high intensity storms, erosion could increase because there is less ground cover. In addition, other destructive activities to ground vegetation associated with fire suppression such as fire line construction, staging areas and safety zones could occur if a wildfire were to ignite. Therefore, bare ground near Three Creek could be exposed, which increases the risk of sedimentation in Three Creek if a wildfire were to occur.

Table 9. Issues and measures to analyze effects to sedimentation..

Issue	Measures	Alterative 1	Alternative 2 & 3
Erosion and Sedimentation	Acres of soil detrimentally impacted in Riparian Reserves.	0	0
	Acres of soil detrimentally impacted within 30 ft of potentially hydrologically connected areas (ephemeral draws).	0	0
	Miles of hydrologically connected road closed or decommissioned	0	6.4
	Miles of hydrologically connected temporary road constructed or used.	0	0
	Percent of project area with a high or moderate fire hazard rating.	(H) 45% (M) 23%	(H) 7% (M) 13%

Direct and Indirect Effects –Alternative 2 & 3

Sedimentation from activities associated with the Action Alternatives in the streams in the project area would be negligible because no detrimental soil acres would occur in Riparian Reserves or hydrologically connected areas and project design elements would reduce sedimentation from haul roads.

Vegetation treatments outside of the Riparian Reserves that could affect sedimentation are the same as the ones discussed in the Streamflow Effects section of this report for overland flow. As discussed, the ponderosa pine dwarf mistletoe treatments and mixed conifer with group opening treatments (Alt. 2 only) would reduce the amount of vegetation interception and evapotranspiration and may trap more snow. All of these processes could increase overland flow, hillslope erosion, and potentially sedimentation and more erosive high streamflows if

these areas drain to streams. Given that none of treatments are located within Riparian Reserves or hydrologically connected areas, overland flow effects from these treatments would not affect sedimentation. Any potential hillslope erosion caused from these activities would be trapped in the ground vegetated buffer between the treatments and the streams

Project design elements would reduce sedimentation from log haul (see Project Design Criteria and BMP section). Sedimentation from haul would be minimal because no new roads would be constructed, no temporary roads would be used in Riparian Reserves, no haul roads would ford any creeks when they are flowing, no landings would be constructed in Riparian Reserves, haul would be restricted to drier conditions when sedimentation to streams would not occur, and regular drainage maintenance would be conducted.

Closing and decommissioning 6.4 miles of road in hydrologically connected areas such as 0.1 miles in Riparian Reserves and 6.3 miles that parallel or cross ephemeral channels would reduce overland flow effects that could cause erosion and subsequent sedimentation. Fracturing the road surface, installing water bars, and allowing the road to revegetate and maintain down wood would reduce sediment contribution to stream channels. Roads proposed for decommissioning maybe subsoiled if physically possible to restore soil infiltration. Subsoiling or ripping could cause some localized, short-term sedimentation effects; however, sedimentation would not likely reach Three Creek because treatments are adjacent to ephemeral channels and not directly near Three Creek.

Fire Hazard Modeling shows that the combined high and moderate fire hazard rating was reduced from 45% to 7% and 23% to 13%, respectively, under Alternatives 2 and 3 (Table 9). Therefore, after vegetation treatments, the likelihood that much of the vegetation in the Riparian Reserves would be denuded from a wildfire would be reduced as would be risk of sedimentation in Three Creek.

Water Temperature

Existing Condition

No waterbodies in the Melvin Butte Vegetation Management Project area are listed on the Oregon 303(d) list for water temperature exceedances above the State standard. There is only a half mile of perennial channel within the Project area and it's located at the upstream project boundary in Three Creek. Water temperature has been measured in Three Creek during stream inventories and has ranged between 9 ^{o}C to 20 ^{o}C using a hand held thermometer, with highest temperatures in August. Water temperature is elevated because surface water from the Three Creek and Little Three Creek Lake is thermally heated and is the primary water sources during the summer months. The State temperature standard for Three Creek is the 7-day average maximum water temperature standard for salmon and trout rearing and migration which is 18° C (ODEQ 2011). It is unclear if Three Creek exceeds the water temperature standard. It's unlikely that the Pole Creek Fire or the Rooster Rock Fire affected stream temperature because the Pole Creek fire only burned a small portion of the Riparian Reserve that was not immediately adjacent to the perennial reach of Three Creek and the Rooster Rock Fire occurred along the intermittent reach of Three Creek that is already dry during the hot period. The intermittent tributaries in the Snow Creek Ditch subwatershed are dry during the hot season and are thought to not exceed State water temperature standards.

Direct and Indirect Effects –Alternative 1

The effect to water temperature and 303(d) status under the No Action Alternative would remain the same as described in the existing condition because no project activities would occur. Over 80 % of the Three Creek drainage area as well as the Riparian Reserve has a high or moderate fire hazard rating. Given that much of the Riparian Reserve along Three Creek has a high or moderate fire hazard rating, it's likely that much of the shade producing vegetation in the Riparian Reserve could be denuded, even in the low fire hazard areas, resulting in increased water temperature. Measures for analysis of temperature effects of the Melvin Butte Vegetation Management Project are shown in Table 10.

Table 10: Issues and measures analyzing effects to water temperature

Issue	Measures	Alternative 1	Alternative 2 & 3
Water Temperature/303(d) listings	Acres harvested in riparian reserves.	0	0
	Percent of project area with a high or moderate fire hazard rating.	45%	7% and 8%

Direct and Indirect Effects –Alternative 2

The Action Alternatives would not affect water temperature because no activities would occur within the Riparian Reserve of any streams. For the same reason, there would be no effect on the 303(d) listing status of streams listed for exceeding State temperature standards. Only activities within the shade producing area (usually within 50-100 ft of a stream) of perennial streams, have the potential to affect shade and associated stream temperature. Intermittent streams in the project area do not contribute to high temperatures because they are dry during the hottest period of the year. Only a half mile of Three Creek is perennial in the Project area and no activities are planned within the shade producing area. In addition, no changes to channel condition are predicted; therefore, morphological channel changes which could affect stream temperature would not occur. Given that only a half mile of stream is perennial, any beneficial effects from reducing the fire hazard in the project area would not have an effect on stream temperature.

Channel Condition

Existing Condition

Riparian Reserves upstream of the Project area around Three Creek, its tributaries and wetlands near the 16 Road, and Three Creek Lake are within the intensive recreation area, and vegetation is primarily composed of Lodgepole pine. Riparian vegetation is mostly confined to the first 10 to 20 ft from the stream/lake bank or within the wetlands. Most of the lodgepole pine in this area is dead and very dense and jack strawed as a result of the bug kill. Some regeneration of small lodgepole pine (approx. 6 ft tall) is present especially along the 16 road. Lodgepole pine seldom grows to large or medium sizes. As a result, small instream woody debris or future instream small woody debris loads are high but large and medium instream woody debris loads are low. The upper reach is in a wetland meadow and only a few trees are available for recruitment; therefore, instream woody debris loads were low. In this area, approximately 60 acres of Riparian Reserve were burned during the Pole Creek fire, none of which were adjacent to the channel and half were only underburned.

Driftwood Campground is along the north shore of Three Creek Lake and there are numerous dispersed campsites along Little Three Creek Lake. Three Creek Meadow campground and numerous hiking and horse trails are located off the 1600-800 road and are adjacent to the wetlands surrounding Three Creek. The campsites have increased compaction around the lakes and wetland and have reduced lakeside vegetation in

some areas. Also, many of the dead trees along the 16 road and in the campgrounds in the Riparian Reserves have been felled and left to mitigate the safety risk.

Downstream of the 16 Road Corridor where Three Creek and its intermittent tributary become confined and higher gradient, hillslopes in the Riparian Reserve are still predominately lodgepole pine with very little riparian vegetation. The Project area lies within this landscape. The 2007 stream survey report stated that pieces of medium and large sized woody debris per mile in Three Creek were high only in reach 1 (intermittent reach in Project area) and 4 (perennial reach upstream of Project area near lake). This is most likely due to larger ponderosa pine and spruce in reach 1 and larger spruce and white fire in reach 4 (see Fisheries Report). Reaches 2 (perennial reach in Project area) and 3 (perennial reach upstream of Project area) were dominated by lodgepole pine and white fir. Approximately 80 acres of Riparian Reserve were burned during the Rooster Rock fire which burned 6.2 miles along the intermittent reach of Three Creek, most of which was mixed mortality (25-75% tree mortality) and most ground vegetation burned.

Riparian Reserves of the two intermittent streams in the Snow Creek Ditch subwatershed are composed of Lodgepole pine, much of which is dead. Down wood in-stream and in the Riparian Reserve is high but future recruitment is low until new vegetation establishes.

Direct and Indirect Effects –Alternative 1

The effect to channel conditions under the No Action Alternative would remain the same as described in the existing condition because no project activities would occur. Within the analysis area, but outside the Project area, 140 acres of Riparian Reserves and 6.2 miles of stream were burned in recent fires. In-stream wood is expected to increase significantly as standing dead trees in riparian areas fall; however, long-term large wood recruitment would be reduced as riparian vegetation recovers. In-stream wood would help mitigate potential increases in peak flows and sedimentation from the Pole Creek Fire by dissipating stream energies, creating new pools, and trapping sediment.

Given that much of the Three Creek Riparian Reserve has a high or moderate fire hazard rating, effects in the event of a wildfire could reduce bed and bank stability by increasing peak flow and sedimentation. In addition, Riparian Reserves would not be providing important shade, nutrients, and cover for many years. In-stream wood would increase in the short-term but long-term wood recruitment would be reduced, thus prolonging channel instability. Measures for analysis of channel condition effects of the Melvin Butte Vegetation Management Project are shown in Table 11.

Table 11: Issues and measures for channel condition.

Issue	**Measures**	**Alternative 1**	**Alternative 2 & 3**
Channel Condition	Alteration of stream/lake bank and bed stability measured by changes in streamflow and sedimentation using measures shown in Tables 8 and 9.	0	0
	Acres treated in floodplain.	0	0
	Acres harvested in potential large wood recruitment areas in Riparian Reserves.	0	0
	Percent of project area with a high or moderate fire hazard rating.	(H) 45% (M) 23%	(H) 7% (M) 13%

Direct and Indirect Effects –Alternative 2 & 3

The Action Alternatives would not negatively affect channel condition because no undesirable effects to streamflow, sedimentation, riparian vegetation, and large woody debris recruitment would occur within riparian protection areas (includes Riparian Reserves and ephemeral drainages) (Table 11). Channel stability would not be compromised by the proposed activities because no trees would be felled within 300 ft of perennial water, 150 ft of intermittent streams, or within or along the banks of ephemeral channels to protect the tree root influence area. Closing and decommissioning 6.4 miles of road in hydrologically connected areas would improve channel stability and near channel vegetation. Streamflow and sedimentation effects are not predicted because no activities besides haul on existing roads would occur under the Action Alternatives (see Streamflow and Sedimentation Effect sections in this report). Riparian vegetation would not be affected because no treatments would occur within the Riparian Reserve. However, ephemeral channel conditions may improve as a result of road closure and decommissioning and may help reduce the downstream streamflow and sedimentation effects. In addition, the likelihood that a wildfire could cause stand replacing mortality in the Riparian Reserves would be reduced by the upland treatments proposed under the Action Alternatives.

Large wood recruitment would not be negatively affected because no treatments would occur within the potential large wood recruitment area. Because there are no debris slide or landslide prone areas outside of Riparian Reserves within the Project area, the primary wood recruitment areas in the Melvin Butte project area are approximately 100 ft on each side of a channel (Benda et al. 2002). Haul on system roads in the Riparian Reserve would not affect streamflow, sedimentation, riparian vegetation, or large wood recruitment. This is because all haul would be on existing roads and would not reduce riparian vegetation or large wood recruitment.

Alternatives 2 and 3 - Cumulative Effects

Hydrology effects from the activities proposed in the Melvin Butte Vegetation Management Project would not incrementally add to cumulative effects because no effects to any hydrology parameters are predicted. In addition, there is a potential that upland vegetation treatments could reduce undesirable effects to hydrology resources if a wildfire were to occur.

The hydrology cumulative effects analysis area for the Melvin Butte Project is the same as the analysis area used for existing condition and direct and indirect effects because it encompasses all the areas upstream and downstream of the Project area that are hydrologically connected to the Project area (see Analysis Methods section). Cumulative hydrology effects different from natural conditions would continue as a result of past or on-going activities or events such as fire suppression, roads in riparian areas, and compaction in riparian areas from past logging and recreation use (i.e. dispersed camping, off-road vehicle use). Cumulative effects from bug kill and recent fires would continue to have the greatest potential effect on hydrology. Cumulative hydrology effects from past activities would be the same as those discussed in the No Action Alternative. Although activities proposed in the Melvin Butte Project could occur in areas that have had past activities, the proposed activities are not predicted to cause any hydrology effects; therefore, the project would not incrementally add to cumulative effects. The only potential cumulative effect to the hydrology resource are beneficial effects from reducing hydrologically connected road miles and the fire hazard rating in the project area.

The only on-going or future foreseeable activities in the Melvin Butte Project area are the Pole Creek Fire Salvage (20 ac of overlap), firewood cutting in the Three Creek Firewood cutting area (2834 ac of overlap), implementation of the Travel Management Rule, and management of invasive plants (Cumulative Effects Tables draft EA). No changes to the existing firewood cutting area would occur under this proposal. Travel management legally restricts motorized access to designated open roads but no physical road closures or decommissioning occur under this rule; therefore, no physical changes occur on the ground and roads that were already closed will remain closed and no new roads will be closed under this decision. Management of invasive plants which includes pulling weeds and, potentially in the future, use of herbicide, will continue. Future herbicide treatments would be localized and would meet strict soil and water guidelines.

On-going or future foreseeable projects that overlap the Melvin Butte hydrology analysis area are the Pole Creek Salvage (55 ac of overlap), Sisters Area Fuels Reduction (SAFR) Project (2,126 ac of overlap), and infrastructure removal in the Three Creek Lake area (Cumulative Effects Tables draft EA). Salvage of burned timber from the Two Bulls Fire is proposed to occur on the private land of Skyline Forest to the east of the Project area. These activities would not affect hydrology resources in the Melvin Butte hydrology analysis area because the Two Bulls Fire area is outside of the hydrology analysis area. Environmental Analyses have been completed for the timber projects in the Melvin Butte hydrology analysis area and no negative hydrology effects were predicted. As a result of the Pole Creek Salvage, SAFR and the Melvin Butte Project up to 33 percent of the Three Creek subwatershed could receive vegetation treatments in the next 5 years. However, none of the projects would treat Riparian Habitat Conservation Areas or Riparian Reserves in the Three Creek drainage. Hydrology effects are not expected from the vegetation, salvage, and fuels projects because activities are focused outside of riparian protection areas, no new roads are proposed, harvest within the Three Creek subwatershed would focus on dead tree and small tree removal (i.e. thinning), and soils and precipitation patterns in these project areas do not usually result in overland flow. Although, evapotranspiration could be reduced in the watershed by the cutting of trees, it would not be at a magnitude or in a location that would have an effect on streamflow or sedimentation. Likewise, streamflow in these project areas is not highly sensitive to reduction in evapotranspiration due to high infiltration rates and low annual precipitation. All cutting or harvest of live trees would be for stand health and fuels reduction, thereby leaving the majority of trees.

Infrastructure removal would include removing the Three Creek Lake Dam, Little Three Creek Lake Dam, and obliterating the ditch that connects the Lakes and the ditch below Three Creek Lake. These activities are proposed to alleviate the risk of dam failure on structures that are no longer needed nor safe. Removal of these features would benefit aquatic resources by restoring natural channel flow and improving aquatic organism passage.

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